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Firm Leverage and Boom-Bust Cycles

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ABSTRACT: This paper explores the dynamic relationship between firm debt and real outcomes using data from 24 European economies over the period of 2000-2018. Based on macro data, it shows that a rise in credit to firms is associated with an increase in employment growth in the short-term, but employment growth declines in the medium-term. This pattern remains similar, even when the changes in credit to households are accounted for. Next, using data from a large sample of firms, it shows that firm leverage buildups predict similar boom-bust growth cycles in firm employment: Firms with a larger increase in leverage experience a boost in employment growth in the short-term, but employment growth decreases in the medium-term. Relatedly, the volatility of employment growth increases in the aftermath of firm leverage buildups. Finally, this paper provides suggestive evidence on the role of a financial channel in the relationship between firm leverage buildups and employment growth. The results show that a rise in firm leverage is associated with a persistently higher debt service ratio, pointing the drag on finances. Consistently, boom-bust growth cycles in the aftermath of firm leverage buildups are not limited to employment growth, but are also pronounced for investment. Moreover, the medium-term decline in firm employment growth as predicted by leverage buildups becomes even larger if aggregate financial conditions tighten. The findings are in favor of “lean against the wind” approach in policy making.

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WORKING PAPERS

Firm Leverage and Boom-Bust Cycles

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Contents

1. Introduction

A rapidly growing empirical literature on leverage cycles shows that expansions in aggregate credit are associated with boom-bust cycles in macroeconomic outcomes. This literature documents that credit buildups in the boom phase are associated with elevated macro-financial stability risks and a subsequent decline in economic activity (e.g., Gourinchas and Obstfeld 2012, Schularick and Taylor 2012, Jorda et al. 2013).[2] I explore the dynamic nature of this relationship focusing on firm leverage and using both aggregate and firm-level data from Europe over the last two decades. I show that expansions in firm leverage predict boom-bust growth cycles in real outcomes, and financial constraints seem to play a role in this relationship.

This study contributes to the understanding of the relationship between credit dynamics and real outcomes, particularly focusing on firm indebtedness. In this regard, several studies examine boom-bust cycles by distinguishing between household and firm debt dynamics, with mixed results. For instance, based on aggregate data from 30 countries over the period of 1960-2012, Mian et al. (2017) finds that the role of credit in boom-bust cycles in macroeconomic outcomes is primarily driven by accumulation of household debt, rather than expansions in firm debt. They show that in the aftermath of a rise in household debt, GDP growth increases in the short-term, but it declines in the medium-term. However, they do not find much evidence on a similar cycle in the case of an increase in firm debt. Although there is no clear-cut theoretical explanation behind this distinction, Mian et al. (2017) discusses several potential mechanisms, including (i) the link between household debt and housing prices, and (ii) the elasticity of households to the changes in credit supply, driven by time inconsistency, overoptimism, or overconfidence. However, whether those suggested mechanisms indeed lead to such a difference regarding the role of household and firm debt in real outcomes ultimately is an empirical question. For example, a more recent study by Greenwood et al. (2022) uses macro data from more than 40 countries since the 1950s, and finds that a rise in both household and firm debt can similarly predict subsequent economic downturns.

Moreover, theoretical contributions going back to Myers (1977) and focusing on firm-level dynamics, propose various explanations why firm leverage buildups can predict future declines in economic activity. In the short-term, an increase in firm leverage can relax financial constraints and allow firms to expand their production activities, thereby contributing to economic performance. However, in the medium-term, leverage buildups can raise balance sheet risks such as debt overhang risk, increase financial vulnerabilities, and tighten financial constraints that firms face, thereby leading to a decline in economic activity (e.g., Bernanke Gertler 1989, Kiyotaki and Moore 1997, Bernanke et al. 1999). Several models suggest that firm borrowing is associated with various externalities which can result in overborrowing in the equilibrium, and ultimately deteriorate economic outcomes (e.g., Lorenzoni 2008, Jeanne and Korinek 2010, Bianchi 2011, Korinek and Simsek 2016).

[2] Several papers also provide evidence on the persistent decline in economic activity in the aftermath of financial crises (Cerra and Saxena 2008, Hardy and Sever 2021).

In this paper, I shed light on the dynamic relationship between firm debt and real outcomes using both aggregate and firm-level data from 24 European economies over the period of 2000-2018. Based on macro data, I show that a rise in credit to firms is associated with boom-bust cycles in aggregate employment growth: Expansions in credit to firms predict an increase in employment growth in the short-term, but employment growth declines in the medium-term. This pattern remains similar when even the changes in household debt are accounted for. These findings seem to be different from the ones presented by Mian et al. (2017) which shows that an increase in firm debt has little predictive power in boom-bust growth cycles in real outcomes. In addition, although I find a medium-term decline in employment growth in the aftermath of a rise in household debt similar to Mian et al. (2017), but as opposed to their findings, there is not much evidence on the short-term positive role of expansions in household debt in employment growth in the present sample.[3]

Next, using data from a large sample of firms from the ORBIS database, I find that firm leverage buildups predict boom-bust growth cycles in firm employment as well: Firms with a larger increase in leverage experience a boost in employment growth in the short-term, whereas employment growth decreases in the medium-term. This is similar to the finding in Giroud and Mueller (2021), which examines a similar dynamic relationship in the case of the US firms. I also show that these boom-bust cycles in employment growth as predicted by firm leverage buildups are associated with an increase in the volatility of employment growth both in the short- and medium-term.

Finally, I provide suggestive evidence on the role of financial constraints in the medium-term relationship between firm leverage buildups and employment growth by focusing on firm balance sheet and investment, as well as by exploiting the cross-country heterogeneity in financial conditions. The results show that firms with a larger increase in leverage face balance sheet pressures in the medium-term. In particular, those firms persistently use larger fractions of their earnings for interest payments, leaving less resources for production activities, thereby potentially hindering employment growth in the medium-term. Consistently, boom-bust growth cycles as predicted by firm leverage buildups are not restricted to employment, but are also pronounced for investment: Firm leverage buildups promote investment in the short-term, while holding investment back in the medium-term. Lastly, exploring the role of aggregate financial conditions, the findings show that firms with an initially larger expansion in leverage experience even larger declines in employment growth in the medium-term if financial conditions tighten, further pointing to a financial channel. These findings are in line with the recent firm-level empirical literature which adopts leverage as a proxy for financial vulnerabilities and finds that leverage buildups elevate financial fragility, making firms more prone to various shocks (Cai and Zhang 2011, Giroud and Mueller 2017, Ahn et al. 2020, Duval et al. 2020, Arbatli-Saxegaard et al. 2022, Kalemli-Ozcan et al. 2022).[4]

[3] Similar patterns are reflected in GDP dynamics as well: A rise in credit to firms is associated with boom-bust cycles in GDP growth, whereas an increase in household debt seems to be negatively associated with GDP growth both in the short- and medium-term.

[4] It is also worth noting that the study by Baker and Zeng (2013) focuses on macro data and finds that the differences in economic performance across Europe following the 2008 financial crisis are primarily driven by the need to adjust corporate balance sheets (which weakened during the pre-crisis boom years with large increases in corporate debt), thereby contributing to reduced investment and employment in some countries in the post-crisis era.

The empirical specifications adopt 3-year "sliding windows" to make the results comparable with Mian et al. (2017) and Giroud and Mueller (2021). The explanatory variable is the change in firm debt between year $t-3$ and t. The dependent variable is employment growth over the periods of $t-3$ and t; $t-2$ and $t+1$; $t-1$ and $t+2$; t and $t+3$; $t+1$ and $t+4$; and $t+2$ and $t+5$ (in six different regressions). The results based on aggregate data suggest that a one standard deviation increase in credit to firms (as share of GDP) is associated with a 0.8 percentage points boost in aggregate employment growth within the same time span (i.e., between $t-3$ and t). This is economically important, given that the mean employment growth in the sample (over a 3-year period) is 2.2 percent. However, this positive relationship switches to negative in the medium-term. For instance, the same amount of increase in credit to firms (between $t-3$ and t) predicts a 1.9 percentage points lower growth in aggregate employment between $t+2$ and $t+5$. I conclude that a rise in credit to firms predicts boom-bust growth cycles in aggregate employment. This pattern in the macro data remains similar, even when the changes of household debt are accounted for. Moreover, an increase in household debt does not seem to be associated with a boost in aggregate employment growth in the short-term, but aggregate employment growth declines in the medium-term following a rise in credit to households.

Firm-level data come from the ORBIS database which is a unique cross-country longitudinal dataset. It includes both listed and unlisted firms. This differentiates ORBIS from other widely used datasets that provide information only on large and listed companies, such as Compustat for the US, Compustat Global, or Worldscope. This feature of the database is particularly important in the context of this study, since smaller firms likely face greater financial constraints relative to large/listed firms (Beck et al. 2005, ECB 2013, Gopinath et al. 2017). A major advantage of focusing on the European subsample of ORBIS is that company reporting is regulatory (including for small private firms) for many countries. In addition, using ORBIS is economically important in the case of Europe, given that small and medium size enterprises (SMEs) account for a large fraction of economic activity in Europe. The ORBIS database has comprehensive firm and industry coverage, particularly starting from the 2000s. The raw data, however, requires various steps to ensure consistency and clean reporting errors, as well as merging different vintages. The final dataset is constructed in line with the methodology proposed by Kalemli-Ozcan et al. (2015), Gopinath et al. (2017) and Diez et al. (2021a). The main sample covers non-farm, non-financial economic activities including both service (e.g., real estate and professional/scientific/technical activities) and non-service industries (e.g., manufacturing and mining).

Firm-level estimations show that firm leverage buildups are associated with boom-bust growth cycles in firm employment similar to the aggregate pattern. The results suggest that a one standard deviation increase in leverage is associated with a 0.5 percentage points boost in employment growth within the same time span (i.e., between $t-3$ and t). It is sizable, since the mean employment growth in the ORBIS sample (over a 3-year period) is 1.3 percent. However, this relationship switches to negative quickly, and leverage buildups predict a decline in firm employment growth in the medium-term. For instance, a one standard deviation rise in leverage (between $t-3$ and t) is associated with a 1.2 percentage points lower employment growth between t and $t+3$. I also show that boom-bust cycles in employment growth as predicted by firm leverage buildups are also associated with an increase in the volatility of firm employment growth both in the short- and medium-term.

Although it is hard to make a causal claim, the firm-level empirical specifications absorb the effects of other factors on firm employment growth at a very granular level to alleviate the issue of omitted variables. In particular, the firm-level regressions include firm fixed effects to control for the impact of all firm-level time-invariant variables on employment growth. They also include country-industry-year fixed effects to isolate the variation in firm employment growth arising from the underlying factors (such as supply or demand shocks) that are common across firms in each country, narrowly defined 4-digit NACE industry and year cell.

In addition, I employ several tests to rule out various alternative explanations for the dynamic relationship between firm leverage buildups and employment growth, namely employment convergence, firm expansion and mean reversion. First, if employment levels tend to converge across firms (i.e., if firms with initially a higher number of employees exhibit a lower employment growth over time), to the extent that leverage buildups are associated with a higher level of employment to begin with, future declines in firm employment growth can be explained by convergence. Next, if larger increases in leverage are related to firm (over-) expansions, the latter can be the driving force of the subsequent decrease in employment growth. Third, if there is mean reversion in firm employment growth, to the extent that initial leverage expansions are associated with a higher employment growth in the short-term, the negative medium-term relationship between firm leverage buildups and employment growth can be driven by this mean reversion. The results suggest that although these channels seem to be important for employment dynamics, they do not alter the dynamic relationship between firm leverage buildups and employment growth.

In the last step, I provide suggestive evidence on the role of a financial channel in the dynamic relationship between firm leverage buildups and employment growth. To start with, an intuitive balance sheet variable to focus on is firm debt service ratio, which captures the drag on finances arising from debt payments and serves a proxy for financial distress encompassing both solvency and liquidity (Diez et al. 2021b, Kalemli-Ozcan et al. 2022). As firm leverage increases, this can elevate pressures in firm balance sheet in the form of higher interest payments, possibly crowding out resources which can be used for production activities otherwise. The results show that firms with larger leverage buildups persistently use a larger fraction of their earnings to meet interest payments, pointing to a worsening in firm balance sheet over time. This increase in financial pressures in the medium-term suggests that the drag on finances plays a role in the previous pattern.

Second, I investigate the dynamic relationship between firm leverage buildups and investment. If leverage buildups are associated with financial constraints that firms face, it can be expected that a rise in firm leverage would also predict lower investment in the medium-term. The results are consistent: Firm leverage buildups predict a higher investment in the short-term, but with a lower investment rate in the medium-term. The findings suggest that a one standard deviation increase in leverage is associated with a 4.8 percentage points increase in investment rate in the same period (i.e., between $t-3$ and t). It is large given that the mean investment rate in the sample is 7.2 percent. Nevertheless, this association switches to negative in the medium-term. For instance, the same increase in firm leverage (between $t-3$

and t) predicts a 3.7 percentage points lower investment rate between t and $t+3$. I conclude that boom-bust cycles as predicted by firm leverage buildups are not restricted to employment growth, but are also pronounced for investment.

Last but not least, I exploit heterogeneity across countries to investigate the role of aggregate financial conditions in the relationship between firm leverage buildups and employment growth. If the medium-term association between firm leverage buildups and employment growth is driven by a financial channel, a tightening in aggregate financial conditions can affect this relationship. That is, an increase in leverage can make firms more subject to financial shocks, and as a result, a larger-than-expected tightening in financial conditions (proxied by the forecast errors of long-term interest rates) can exacerbate the medium-term decline in employment growth as predicted by leverage buildups. The results are consistent with this reasoning: As financial conditions become tighter, firms with larger leverage expansions experience disproportionately higher losses in employment growth in the medium-term, further pointing to the role of a financial channel in the previous findings.

This paper adds to the literature on leverage cycles (as cited before) by showing that a rise in firm debt predicts boom-bust cycles in real outcomes based on both aggregate and firm-level data from Europe. Mian et al. (2017), Giroud and Mueller (2021) are the closest studies to the present one. The former focuses on the dynamic relationship between accumulation of debt and real outcomes based on aggregate data. It finds that a rise of household debt seems to be a better predictor of boom-bust cycles in real outcomes, compared to that of firm debt. As noted above, the results in the first part of the paper seem to be different from the findings in that paper, possibly driven by a different sample (regarding both the countries and the time span). However, it is also worth noting that the medium-term patterns as found in the present study are consistent with the findings in Greenwood et al. (2022). This indeed highlights the need for new theories to shed light on the conditions under which household and firm debt can have similar or different implications for boom-bust cycles in real outcomes.

On the other side, the study by Giroud and Mueller (2021) tests the dynamic relationship between leverage buildups and employment growth using data from the US firms over the period of 1976-2011. The authors find that leverage buildups predict an increase in employment growth within the same period, whereas this relationship switches to be negative in the medium-term. I investigate a similar relationship in a cross-country setting for a large sample of European firms from ORBIS over the period of 2000-2018.[5] In the first step of the firm-level analysis, I show that the dynamic relationship between firm leverage and employment growth is not specific to the firms from the US, but also holds for European firms. In addition, I find that leverage buildups have implications for the volatility of employment growth, besides its growth rate. Finally, I provide suggestive evidence on the role of tightening financial constraints in this firm-level pattern. To start with, firms with higher leverage buildups face balance sheet pressures (in the form of higher interest payments), possibly hindering employment growth in the

[5] I note that I treat leverage buildups as given, and examine whether they are associated with subsequent economic outcomes, similar to the previous literature focusing on the relationship between leverage and real economic activity (e.g., Schularick and Taylor 2012, Giroud and Mueller 2021). There may be various firm-specific reasons behind leverage expansions, as discussed by several papers (e.g., Frank and Goyal 2009, Graham and Leary 2011).

medium-term. Second, boom-bust growth cycles as predicted by firm leverage buildups are not limited to employment, but are also pronounced for investment.[6] Furthermore, I exploit the cross-country heterogeneity in financial conditions, and show that the medium-term decline in employment growth following a rise in firm leverage becomes even larger, if aggregate financial conditions tighten.

The remainder of this paper is organized as follows. Section 2 introduces the data. Section 3 illustrates the empirical methodology. Section 4 shows and discusses the findings. Section 5 concludes.

2. Data

2.1. Country-level Data

Data on credit to non-financial corporations (as percent of GDP) is from the European Credit Research Institute database (ECRI 2021 Statistical Package). I also adopt credit to households from the same database. Data on aggregate employment comes from the OECD database. I use real GDP from the World Bank World Development Indicators database. Country-level variables are winsorized at the 1st and 99th percentiles to reduce the effect of outliers. The sample is same as the firm-level regressions as described in detail below.

To examine the role of aggregate financial conditions in the medium-term relationship between firm leverage buildups and employment growth, I adopt data on long-term interest rates.[7] I use forecast errors of long-term (10-year) government bond yields (i.e., the rate minus its forecast) following Ahn et al. (2020). Data on yields are from the OCED database. Forecasts for a given year are pulled from the fall issue of the OECD Economic Outlook in the previous year. OECD forecasts are calculated based on an overall assessment of individual countries as well as global conditions, with the fall issue at year $t-1$ utilizing the available information to forecast the rate at year t. Therefore, forecast errors are an intuitive and straightforward measure of a more-than-expected tightening in financing conditions in a country for a given year.

[6]The medium-term relationship between leverage buildups and investment is also consistent with Albuquerque (2021) which shows that larger increases in leverage are associated with low investment rates in the medium-term based on the data from the listed firms in the US.

[7] An advantage of long-term rates, beyond having enough cross-country variation in the sample used in this paper, is to capture financing conditions for firms in a broader sense compared to short-term policy rates, and to envisage the effect of both conventional and unconventional monetary policy measures (Ahn et al. 2020).

2.2. Firm-level Data

Firm-level data come from the ORBIS database which is a unique cross-country longitudinal dataset of both listed and unlisted firms. It is compiled by the Bureau van Dijk Electronic Publishing (BvD) through a data collection process from many providers. It provides harmonized and rich information on firm productive activities (such as employment and sales) and balance sheet variables (such as liabilities and assets). About 99 percent of firms in the dataset set are private. This differentiates ORBIS from other data sets which are widely used by the literature, e.g., Compustat for the US, Compustat Global, or Worldscope, but have information only on large/listed companies. This feature of the database is particularly important in the context of this study, since smaller firms depend more on debt financing, and likely face greater financial constraints relative to larger firms (Beck et al. 2005, ECB 2013, Gopinath et al. 2017).

A major advantage of focusing on the European subsample of ORBIS is that company reporting is regulatory including for small/private firms for many countries. Relatedly, ORBIS covers a reasonable share of the aggregate economic activity, and is viewed as representative in terms of the activities of SMEs in several European countries, as analyzed in detail by Kalemli-Ozcan et al. (2015), Gopinath et al. (2017) and Diez et al. (2021a). Moreover, using ORBIS is particularly sensible for the case of Europe, since SMEs are defined as “the backbone of Europe's economy”, and play a crucial role on job creation and growth. They correspond to about 99 percent of all businesses in Europe, accounting for more than half of the Europe’s GDP.[8] It is worth noting that the majority of firms in the sample is SMEs (accounting for around 98 percent of all observations) based on the definition by the Eurostat (i.e., with less than 250 employees).[9]

The ORBIS database has comprehensive coverage particularly starting from the 2000s. The raw data, though, requires an intensive process to ensure internal consistency and clean basic reporting errors (such as negative total assets or employment) together with merging several vintages. The dataset used in the present study is processed and “cleaned” as proposed by Kalemli-Ozcan et al. (2015), Gopinath et al. (2017) and Diez et al. (2021a). The main sample covers non-farm, non-financial industries (restricted by NACE 2-digit codes with the range of 5-82) including both several service (e.g., real estate and professional/scientific/technical activities) and non-service industries (e.g., manufacturing and mining), as listed in the Appendix (with about 2,5 million firms and 15,7 million observations in the largest sample). The sample consists of 24 advanced European economies over the period of 2000-2018: Austria, Belgium, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Ireland, Iceland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Norway, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, and the United Kingdom.

Firm leverage is defined as total liabilities as percent of total assets. As an alternative measure of leverage, I adopt the ratio of net liabilities (i.e., total liabilities minus cash) to total assets. I also obtain the

[8] For instance, see https://single-market-economy.ec.europa.eu/smes_en.

[9] The median (mean) value of the number of employees is 5 (17), as illustrated in the Appendix.

data on the number of employees. In a robustness, I control for sales growth, as a proxy for firm expansion. To test the relationship between leverage and investment, I use the change in fixed assets.[10] Finally, to examine the relationship between firm leverage buildups and financial distress, I calculate firm debt service ratio as the percentage of interest payments to EBITDA (earnings before interest, taxes, depreciation and amortization) following Kalemli-Ozcan et al. (2022). All firm-level variables are winsorized at the 2.5th and 97.5th percentile levels to reduce the influence of outliers. The Appendix provides the summary statistics.

3. Methodology

3.1. Aggregate Credit and Employment Dynamics

The goal is to examine the dynamic relationship between credit expansions and employment growth at the aggregate-level. For this purpose, I use panel regressions with fixed effects. The analysis is based on 3-year sliding windows in line with Mian et al. (2017) and Giroud and Mueller (2021). The specification is as follows:

$$\Delta \log(Employment)_{c,t}(t+p-3, t+p) = \alpha \Delta Firm\ credit_{c,t}(t-3, t) + \theta_c + \theta_t + \epsilon_{c,t} \quad (1)$$

where c and t stand for country and year, respectively. The explanatory variable is the change in credit to nonfinancial firms (in percentage points of GDP) from $t-3$ to t. The dependent variable is the change in log employment (i.e., the number of employees) for several periods, expressed in percent. I run the specification in equation 1 for $p = 0, \dots, 5$ to examine the role of expansions in firm credit from $t-3$ to t in employment growth during the periods of $t-3$ and t; $t-2$ and $t+1$; $t-1$ and $t+2$; t and $t+3$; $t+1$ and $t+4$; and $t+2$ and $t+5$. This leads to six regressions exploring this relationship both in the short- and medium-term. When $p = 0$, the coefficient estimate (α) captures the short-term relationship between buildups in firm credit and employment growth. As p increases, it examines this relationship over the medium-term. A positive (negative) coefficient estimate would imply that an increase in credit to firms is associated with an increase (a decrease) in employment growth during the corresponding period (i.e., between $t+p-3$ and $t+p$).

Country (θ_c) and year (θ_t) fixed effects are included to isolate the effects of all country-level time invariant factors, as well as any annual developments or shocks that are common across countries, on employment growth. Standard errors are robust to heteroskedasticity.

[10] Investment in capital can be measured in net or gross terms. If capital expenditures only compensate the depreciation of existing capital, this would make gross investment positive, whereas net investment would be unchanged. In the literature, the common approach is to use net investment (i.e., the change in fixed assets), since it matters more for production (e.g., Kalemli-Ozcan et al. 2022). Another advantage of using investment on the net basis is the limited availability and reliability of data on the depreciation of capital. I also note that the results are based on total fixed assets (i.e., the sum of tangible and intangible fixed assets), but the findings remain similar when this analysis is employed by using tangible fixed assets.

In separate regressions, I examine this relationship by replacing the right-hand side variable with the change in credit to households (in percentage points of GDP), i.e., $\Delta Household\ credit_{c,t}(t-3,t)$. Next, I include the changes in both firm and household credit in the estimation to make sure that the dynamic relationship between expansions in credit to firms and employment growth still holds, when household debt dynamics are accounted for. In another test, I use the log change in real GDP, i.e., $\Delta GDP_{c,t}(t+p-3,t+p)$, as the dependent variable to investigate this relationship for economic growth.

3.2. Firm Leverage Buildups and Employment Dynamics

Next, I investigate the dynamic relationship between firm leverage buildups and employment growth by exploiting the firm-level heterogeneity. Similar to the estimation above, I use panel regressions with fixed effects based on 3-year sliding windows. The specification is as follows:

$$\Delta\log(Employment)_{j,t}(t+p-3,t+p) = \alpha\Delta Leverage_{j,t}(t-3,t) + \theta_j + \theta_{c,i,t} + \epsilon_{j,t} \quad (2)$$

where j, c, i and t stand for firm, country, (4-digit NACE) industry and year, respectively. The explanatory variable is the percentage points change in firm leverage from $t-3$ to t. The dependent variable is the change in the log employment (i.e., the number of employees) for different periods, expressed in percent. I similarly run these regressions for six periods (i.e., $p = 0, \dots, 5$) to investigate the role of firm leverage growth from $t-3$ to t in firm employment growth during the periods of $t-3$ and t; $t-2$ and $t+1$; $t-1$ and $t+2$; t and $t+3$; $t+1$ and $t+4$; and $t+2$ and $t+5$.

The specification in equation 2 includes firm (θ_j) and country-industry-year ($\theta_{c,i,t}$) fixed effects. Although it is hard to claim causality, these fixed effects mitigate potential concerns about omitted variables to a large extent. Firm fixed effects absorb the effect of all firm-level time invariant characteristics on employment growth. Country-industry-year fixed effects isolate the impact of all factors (such as supply or demand shocks), which are common for all firms in a country in a given industry in a year, on firm employment. This set of fixed effects absorbs the sources of variation underlying the relationship between firm leverage and employment growth at a very granular level. To better understand the granularity of this approach, one can consider the manufacturing industry (with the NACE code C). In manufacturing, there are 2-digit industries with the NACE codes in the range of 10-33. One of those 2-digit industries is food production (NACE code 10). Under that, there are 3-digit industries with the NACE codes ranging from 101 to 109, one of which is the manufacturing of dairy products (105). There are two 4-digit industries within this category, namely ice cream (1052) and cheese production (1051). With the inclusion of country-4-digit-industry-year fixed effects ($\theta_{c,i,t}$), the specification in equation 1 controls for the effects of all variables that are common across firms in the 4-digit ice cream production industry (in a given country in a year) on firm employment growth. Throughout the paper, “industry” refers to a 4-digit NACE industry, unless otherwise noted. Standard errors are clustered at the country-industry-year level.

I extend the specification in equation 2 to test several alternative explanations for this relationship. First, I add the initial level of firm employment (at $t-3$) to examine the role of firm employment convergence. Second, I control for firm sales growth (between $t-3$ and t) to test whether firm expansions, or over-expansions, undermines the relationship between leverage buildups and employment growth. Next, I control for firm employment growth between $t-3$ and t to explore the role of mean reversion in the medium-term employment dynamics.

In separate tests, I examine this relationship for the volatility of firm employment growth by adopting a time-variant measure of volatility as the dependent variable - to be described later. Next, I explore the association between firm leverage buildups and debt service ratio (interest payments as percent of EBITDA) where the dependent variable is $DSR_{j,t+p}$. Finally, I investigate a similar for investment by replacing the dependent variable with the change in log fixed assets, i.e., $\Delta\log(Fixed\ assets)_{j,t}$.

In the last step, I test the role of aggregate financial conditions in the medium-term employment dynamics based on firm leverage buildups. The specification is as follows:

$$\Delta\log\left(Employment\right)_{j,t}(t+p-3,t+p)=\alpha\Delta Leverage_{j,t}(t-3,t)+\beta\Delta Leverage_{j,t}(t-3,t)\times X_{c,t}^{p}+\theta_{j}+\theta_{c,i,t}+\epsilon_{j,t} \quad (3)$$

where $X_{c,t}^{p}$ stands for the average forecast errors of long-term interest rates (as a proxy for the surprise component of financial tightening in a country) during each period. For instance, for $p=3$, $X_{c,t}^{p}$ is the average of forecast errors over $t+1$, $t+2$, and $t+3$, gauging the degree of average tightening over the three years during that period. Since the direct role of $X_{c,t}^{p}$ on firm employment growth is absorbed by the country-industry-year fixed effects, the specification in equation 3 is able to capture its differential effect on employment growth based on firm leverage buildups. I estimate this equation for $p=1,\ldots,5$ to investigate whether a future tightening in financial conditions in a country plays a role in firm employment growth in the medium-term, particularly for the firms with a larger leverage buildup in the first period. For instance, when the coefficient estimate for $\alpha<0$ in the regression with $p=3$, if the estimate for $\beta<0$, this would mean that (i) firms with a larger leverage buildup experiences a decline in employment between t and $t+3$, and (ii) this decline becomes even larger if financial conditions turn out to be tighter than expected during that period.

4. Results

4.1. Stylized Facts

4.1.1. Aggregate Patterns

Before going into the regression results, I illustrate several stylized facts. Figure 1 displays the relationship between credit and employment dynamics in the aggregate data and based on 3-year windows in line with the regressions. The left-hand side chart reports the employment growth differentials over time across the observations with high versus low increase in credit to firms (between $t-3$ and t). In particular, the bars for various periods show the difference between the mean values of employment growth across observations with high versus low increase in credit to firms. Aggregate employment growth is net of country and year fixed effects. The subsample with high (low) growth in credit to firms consists of the observations with a change in credit above (below) the sample median (which is 0.3 percentage points of GDP).

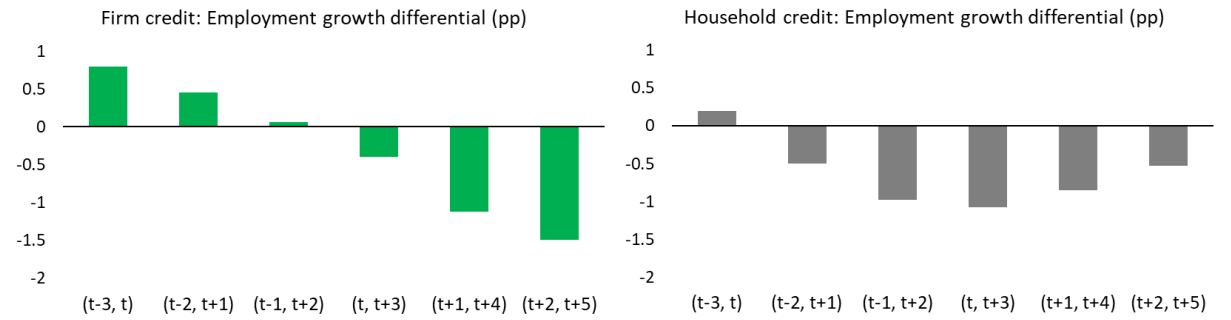
The first bar in the left-hand side chart in Figure 1 illustrates that countries with a higher increase in credit to firms experience a 0.8 percentage points higher employment growth between $t-3$ and t on average, relative to the rest of the sample. This is large, considering that the mean employment growth (over a 3-year period) in the sample is 2.2 percent. This positive differential in employment growth suggests that countries benefit from an expansion in credit to firms in the short-term. Focusing on the next two periods (the second and third bars), this gap in employment growth becomes lower, albeit still being positive. However, it is reversed starting from the fourth period. The last three bars indicate that countries with high buildups in firm credit between $t-3$ and t experience persistently lower employment growth in later periods, compared to other countries which initially have a lower increase in firm credit. For instance, between $t+2$ and $t+5$ (as shown by the last bar), countries with a larger expansion in firm credit see a 1.5 percentage points lower employment growth, relative to the rest of the sample.

The right-hand side chart in Figure 1 follows the same procedure to explore the relationship between the accumulation of household debt and employment growth. It points to a similar pattern, but with some notable differences. To start with, for countries with a larger increase in credit to households, the initial boost in employment growth seems to be smaller, compared to the left-hand side chart: Countries with a larger expansion in household credit experience a 0.2 percentage points higher employment growth in the first period, relative to the rest of the sample. Moreover, this relationship switches to negative immediately after the first period, and stays negative for the rest of the periods. Focusing on the fourth bar (i.e., between t and $t+3$), where the magnitude of employment growth differential is the largest, countries with larger household credit buildups experience a 1.1 percentage points lower employment growth, relative to other countries.

I conclude that there seems to be a systematic pattern between credit expansions and employment growth at the aggregate-level: Greater credit buildups likely boost aggregate employment growth in the short-term, whereas this relationship switches to be negative in the medium-term. Moreover,

the initial boost in employment growth seems to be larger following an expansion in firm credit compared to a rise in credit to households.

Figure 1: Aggregate credit and employment dynamics



Notes: These charts use aggregate data. The left-hand side chart reports the employment growth differential in the indicated periods across the observations with high versus low increase in outstanding credit to firms (as share of GDP) between t-3 and t. Employment growth is net of country and year fixed effects. The reported differential growth in each corresponding period is the difference between the mean values of employment growth for the observations with high and low growth in credit. The observations with high and low credit growth are classified based on the median value of the change in credit to firms. The right-hand side chart follows the same procedure by adopting the change in credit to households. pp: percentage points.

4.1.2. Firm-level Patterns

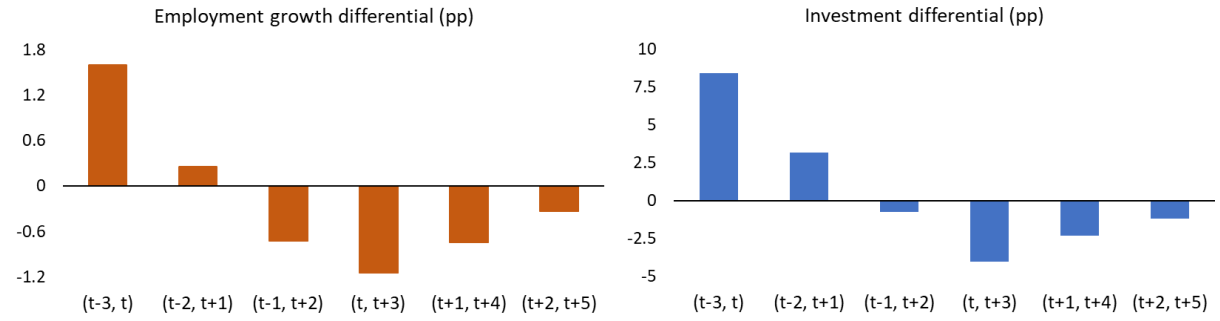
Next, I investigate whether a similar pattern is visible at the firm-level. I focus on the dynamic relationship between firm leverage buildups, employment growth and investment. The left-hand side chart in Figure 2 shows the employment growth differentials over time across firms with high versus low increase in leverage between $t-3$ and t. Firm employment growth is net of country-industry-year fixed effects. The subsample with high (low) leverage growth consists of the observations with a change in leverage above (below) the sample median (which is -1.6 percentage points).

The first bar in Figure 2 suggests that firms with high leverage buildups experience a 1.6 percentage points higher employment growth between $t-3$ and t on average, relative to other firms. This is large, given that the mean employment growth (over a 3-year period) in the ORBIS sample is 1.3 percent. Hence, in the short-term, firms seem to benefit from high leverage buildups in the form of a boost in employment growth. Focusing on the period of $t-2$ and $t+1$ (the second bar), this growth differential becomes much lower, albeit still being positive (0.3 percentage points). The last four bars indicate that firms with high leverage buildups between $t-3$ and t experience persistently lower employment growth in later periods, compared to other firms (which have lower increase in leverage initially). For instance, as shown by the fourth bar, firms with high leverage buildups see a 1.2 percentage points lower employment growth between t and $t+3$, relative to other firms.

The right-hand side chart in Figure 2 follows the same procedure to explore a similar relationship for investment. It reflects a similar fact: Firms with a larger increase in leverage (between $t-3$ and t) experience a higher investment rate in the short-term, but a lower investment rate in the medium-term.

The first bar illustrates that firms with a relatively high increase in leverage have 8.5 percentage points higher rate of investment on average, relative to other firms, within the same period. This is large, considering the mean investment rate in the sample (7.2 percent over a 3-year period). Albeit remaining positive, this investment differential becomes lower in the next period. It is negative for the rest of the periods. For example, as shown by the fourth bar in the right-hand side chart, firms with high leverage buildups experience a 4 percentage points lower investment rate between t and $t+3$, compared to other firms.

Figure 2: Firm leverage buildups, employment growth and investment



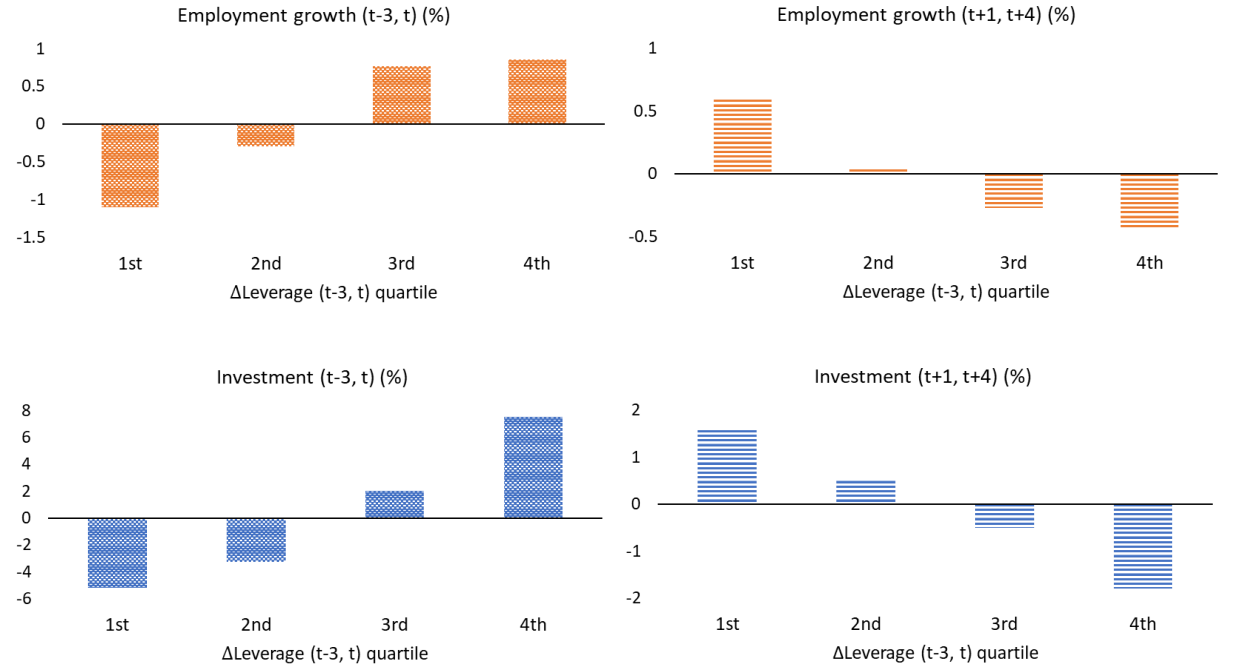
Notes: These charts use firm-level data. The left-hand side chart reports the employment growth differential in the indicated periods across firm-year observations with high versus low increase in leverage between t-3 and t. Firm employment growth is net of country-industry-year fixed effects, where "industry" stands for narrowly defined 4-digit NACE industries. The reported differential growth in each corresponding period is the difference between the mean values of employment growth for the firms with high and low leverage growth. The observations with high and low leverage growth are classified based on the sample median of the change in firm leverage. The right-hand side chart follows the same procedure and reports the investment rate differentials over time across firms with low versus high leverage buildups (between t-3 and t). pp: percentage points.

Alternatively, I focus average employment growth and investment based on the change in firm leverage in the short- and medium-term. Figure 3 illustrates the findings. The left-hand side on the first row shows that firms with a higher increase in leverage between $t-3$ and t experience a higher employment growth in the short-term (i.e., during the same period). For instance, average employment growth for the firms in the first quartile of the change in leverage in the sample is -1.1 percent during the same period. Employment growth increases as we move to the fourth quartile of the change in leverage: Firms that fall under the fourth quartile of the change in leverage (meaning a higher increase in leverage) see 0.9 percent employment growth on average.

The relationship between the change in leverage and employment growth switches to be negative in the medium-term, for instance, by focusing on the period of $t+1$ and $t+4$. The right-hand side on the first row suggest that the firms in the first quartile of the change in leverage (between $t-3$ and t) experience an average employment growth rate of 0.6 percent over the period of $t+1$ and $t+4$. However, the firms with an initially higher increase in leverage (in the fourth quartile) experience -0.4 percent employment growth on average during this period. A similar dynamic relationship is also pronounced in the case of investment, as shown by the charts on the second row in Figure 3.

These patterns in Figure 2 and Figure 3 suggest that leverage buildups are associated with an increase in firm employment growth and investment in the short-term, whereas this relationship switches to be negative in the medium-term. Moreover, the firm-level patterns are broadly in line with the aggregate relationship as illustrated in Figure 1. Motivated by these observations, the next section presents the regression results.

Figure 3: Firm leverage buildups, employment growth and investment over time



Notes: These charts use firm-level data. The charts on the top row report average employment growth across firms based on the change in firm leverage in the sample between t-3 and t. The left-hand side (right-hand side) chart documents average employment growth between t-3 and t (between t+1 and t+4). Firm employment growth is net of country-industry-year fixed effects, where "industry" stands for narrowly defined 4-digit NACE industries. The charts on the second row follow the same procedure and report average investment rate.

4.2. Aggregate Credit and Employment Dynamics

This section examines the dynamic relationship between aggregate credit buildups and employment growth. Table 1 shows the results based on the specification in equation 1 for $p = 0, \ldots, 5$. Column 1 with $p = 0$ examines the short-term relationship between the changes in credit to firms and employment growth. In particular, it focuses on the role of the change in firm credit between $t-3$ and t in aggregate employment growth during the same time span. Column 2 examines the relationship between the change in firm credit between $t-3$ and t and employment growth from $t-2$ to $t+1$, and so on.

The coefficient estimate is positive and statistically significant at the 5 percent level in the first column. The sign of it switches from positive to negative after the first period. The coefficient estimates for the rest of the periods stay negative and statistically significant at the 1 percent level. That is, expansions in credit to firms are associated with an increase in aggregate employment growth in the short-term (as

indicated by the positive coefficient estimate in column 1), but with a decline in employment growth in the medium-term.

The results suggest that the size of the impact is economically significant as well. The coefficient estimate in the first column suggests that an increase in credit to firms in the amount of one standard deviation of the change in the sample (11.2 percentage points of GDP) is associated with a 0.8 percentage points higher employment growth in the short-term. This is important, given that the mean employment growth (over a 3-year period) is 2.2 percent. The result in the last column, where the magnitude of the coefficient estimate is the largest, however, suggests that the same amount of increase in credit to firms predicts a 1.9 percentage points lower employment growth in the medium-term.

Table 1: Firm credit growth and employment dynamics

Variable	$\Delta\log(Employment)_{c,t}$					
	$(t-3,t)$	$(t-2,t+1)$	$(t-1,t+2)$	$(t,t+3)$	$(t+1,t+4)$	$(t+2,t+5)$
$\Delta Firm\ credit_{c,t}(t-3,t)$	0.073**	-0.002	-0.065***	-0.122***	-0.158***	-0.169***
	(0.029)	(0.027)	(0.024)	(0.023)	(0.023)	(0.023)
Country F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.486	0.482	0.524	0.595	0.654	0.661
Observations	366	342	318	294	270	245

Notes: Results are based on equation 1. The explanatory variable is the change in credit to non-financial sector (in percentage points of GDP) between t-3 and t. The dependent variable is the change in aggregate employment (in percent) during the periods as indicated in the columns. Standard errors in parentheses are robust. *** p<0.01, ** p<0.05, * p<0.1.

Next, I explore this relationship for the changes in credit to households. Table 2 illustrates the results. It shows that the initial boost in employment growth, as predicted by expansions in credit to firms in Table 1, is not pronounced in the case of an increase in credit to households. However, when a country sees a larger increase in household debt, employment growth decreases in the medium-term, similar to the results in Table 1. The coefficient estimates suggest that the size of the impact is economically large. For instance, as suggested by the fifth column, where the size of the coefficient estimate is the largest, a one standard deviation increase in credit to households (9.1 percentage points of GDP) between $t-3$ to t is associated with a 1.9 percentage points lower employment growth (over the period of $t+1$ to $t+4$).

Table 2: Household credit growth and employment dynamics

Variable	$\Delta\log(Employment)_{c,t}$					
	$(t-3,t)$	$(t-2,t+1)$	$(t-1,t+2)$	$(t,t+3)$	$(t+1,t+4)$	$(t+2,t+5)$
$\Delta Household\ credit_{c,t}(t-3,t)$	0.004	-0.083***	-0.160***	-0.207***	-0.212***	-0.157***
	(0.030)	(0.031)	(0.030)	(0.030)	(0.032)	(0.035)
Country F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.494	0.517	0.568	0.619	0.643	0.622
Observations	341	318	295	272	249	225

Notes: Results are based on equation 1. The explanatory variable is the change in credit to households (in percentage points of GDP) between t-3 and t. The dependent variable is the change in aggregate employment (in percent) during the periods as indicated in the columns. Standard errors in parentheses are robust. *** p<0.01, ** p<0.05, * p<0.1.

Next, I estimate the specification in equation 1 by including the changes in credit to firms and households at the same time. This is to make sure that the dynamic relationship between expansions in firm credit and employment growth (as shown in Table 1) is not driven household debt dynamics. That is, if expansions in credit to firms somewhat serve as a proxy for that of households, the negative medium-term relationship between firm credit buildups and employment growth can indeed be explained by household debt dynamics. This is particularly important, since Mian et al. (2017) shows evidence on the role of a rise in household credit in boom-bust cycles. Table 3 displays the results. It shows that both the short- and medium-term relationship between a rise in firm credit and employment growth remain similar, even when household credit dynamics are accounted for. Moreover, expansions in household credit predict a decline in employment growth both in the short- and medium-term.

Finally, I test whether a similar relationship is also reflected in economic growth. Given the boom-bust cycles in aggregate employment growth as predicted by firm credit buildups, it can be expected to observe a consistent pattern for economic growth.[11] Table 4 shows that the relationship stays similar to that of employment growth, regarding both firm and household debt. A rise in credit to firms predicts an initial boost in GDP growth, whereas an expansion of credit to households is associated with a decline in GDP growth in the short-term. The medium-term patterns are also similar: An expansion in both firm and household debt is associated with a decrease in GDP growth in the medium-term.

[11] Moreover, Mian et al. (2017) mainly focuses on GDP to explore the relationship between expansion in different types of credit and boom-bust growth cycles. Hence, this result is more comparable with theirs.

Table 3: Credit growth and employment dynamics

Variable	$\Delta\log(Employment)_{c,t}$					
	$(t-3,t)$	$(t-2,t+1)$	$(t-1,t+2)$	$(t,t+3)$	$(t+1,t+4)$	$(t+2,t+5)$
$\Delta Firm\ credit_{c,t}(t-3,t)$	0.125***	0.042	-0.023	-0.090***	-0.123***	-0.128***
	(0.044)	(0.040)	(0.029)	(0.027)	(0.029)	(0.029)
$\Delta Household\ credit_{c,t}(t-3,t)$	-0.093**	-0.116***	-0.141***	-0.132***	-0.112***	-0.058
	(0.039)	(0.038)	(0.033)	(0.034)	(0.036)	(0.037)
Country F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.534	0.522	0.569	0.641	0.686	0.671
Observations	341	318	295	272	249	225

Notes: Results are based on equation 1. The explanatory variable is the change in credit to non-financial sector (in percentage points of GDP) between t-3 and t. The change in credit to households (in percentage points of GDP) between t-3 and t is also included. The dependent variable is the change in aggregate employment (in percent) during the periods as indicated in the columns. Standard errors in parentheses are robust. *** p<0.01, ** p<0.05, * p<0.1.

Table 4: Credit growth and GDP dynamics

Variable	$\Delta\log(GDP)_{c,t}$					
	$(t-3,t)$	$(t-2,t+1)$	$(t-1,t+2)$	$(t,t+3)$	$(t+1,t+4)$	$(t+2,t+5)$
$\Delta Firm\ credit_{c,t}(t-3,t)$	0.094**	0.010	-0.070*	-0.123***	-0.173***	-0.202***
	(0.045)	(0.042)	(0.036)	(0.039)	(0.045)	(0.054)
$\Delta Household\ credit_{c,t}(t-3,t)$	-0.182***	-0.213***	-0.208***	-0.203***	-0.166***	-0.074
	(0.051)	(0.048)	(0.049)	(0.051)	(0.056)	(0.055)
Country F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.634	0.653	0.687	0.717	0.730	0.705
Observations	341	318	295	272	249	225

Notes: Results are based on equation 1. The explanatory variable is the change in credit to non-financial sector (in percentage points of GDP) between t-3 and t. The change in credit to households (in percentage points of GDP) between t-3 and t is also included. The dependent variable is GDP growth (in percent) during the periods as indicated in the columns. Standard errors in parentheses are robust. *** p<0.01, ** p<0.05, * p<0.1.

4.3. Firm Leverage Buildups and Employment Dynamics

Having established the pattern between expansions in credit to firms and employment growth at the aggregate-level, I now focus on the dynamic relationship between firm leverage buildups and employment growth. Table 5 shows the results based on the specification in equation 2 for $p = 0, \dots, 5$.

The coefficient estimates are statistically significant at the 1 percent level in all columns. However, the sign switches from positive to negative after the first period. That is, leverage buildups are associated with an increase in firm employment growth in the short-term (as indicated by the positive coefficient estimate in column 1), but with a decline in employment growth in the rest of the periods. The magnitude of it suggests that a rise in leverage in the amount of one standard deviation of the change in

leverage (21.3 percentage points) between $t-3$ and t is associated with a 0.5 percentage points higher employment growth during the same period. This is economically important considering that the mean value of the 3-year employment growth in the ORBIS sample is 1.3 percent.

The relationship between the change in firm leverage and employment growth switches to negative after the first period. As illustrated by the rest of the columns, a higher leverage increase is associated with a lower employment growth over the medium-term. For instance, the result in the fourth column, where the magnitude of the coefficient estimate becomes the largest, suggests that a one standard deviation leverage buildup (over the period of $t-3$ and t) is related to a 1.2 percentage points lower employment growth between t and $t+3$.[12]

Table 5: Firm leverage buildups and employment growth

Variable	$\Delta\log(Employment)_{j,t}$					
	$(t-3,t)$	$(t-2,t+1)$	$(t-1,t+2)$	$(t,t+3)$	$(t+1,t+4)$	$(t+2,t+5)$
$\Delta Leverage_{j,t}(t-3,t)$	0.025***	-0.030***	-0.055***	-0.058***	-0.025***	-0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Firm F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Country-industry-year F.E.	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.359	0.383	0.389	0.386	0.404	0.419
Observations	15,716,519	11,232,556	9,345,424	8,346,025	6,407,734	5,142,150

Notes: Results are based on equation 2. The explanatory variable is the change in firm leverage between t-3 and t. The dependent variable is the change in firm employment (in percent) during the periods as indicated in the columns. Industry stands for 4-digit NACE industries. Standard errors in parentheses are clustered at the country-industry-year level. *** p<0.01, ** p<0.05, * p<0.1.

I conclude that firm leverage buildups are associated with a boost in firm employment growth in the short-term, whereas this positive relationship is reversed quickly, and remains negative in the medium-term. This finding confirms the dynamic relationship between leverage and employment growth in the US firms (as shown by Giroud and Mueller 2021) by using data from a large sample of European firms.

[12] Alternatively, one can focus on the tails of the distribution, for instance, by looking at the predicted change in employment growth as a firm increases its leverage to move from the 5th to 95th percentile of the change in leverage in the sample. The coefficient estimate in the first column suggests that such a large increase in firm leverage (i.e., 76 percentage points increase) is associated with a 1.9 percentage points boost employment growth in the same period. The coefficient estimate in the fourth column suggests that the same amount of increase in firm leverage predicts a 4.4 percentage points lower employment growth between t and t+3.

4.4. Robustness

4.4.1. Dummy Variable Approach

In this section, instead of using the exact values of the change in firm leverage, I adopt a dummy variable approach to compare employment dynamics across the cases with low and high leverage buildups. This is to alleviate, if any, concerns about the influence of large fluctuations in leverage. First, I assign a dummy variable for large leverage increases by splitting the firm-year observations based on the sample-wise change in leverage (similar to the stylized fact as illustrated in Figure 2). The dummy variable takes 1, whenever the change in firm leverage is above the sample median, and 0 otherwise. Panel A in Table 6 shows that the findings are consistent: Firms with a larger increase in leverage see higher employment growth in the shorter term, whereas their employment growth becomes smaller in the medium-term, relative to other firms in the sample.[13]

Next, I adopt a more granular approach to compare observations within country-industry cells. For this purpose, I create a dummy variable for high leverage buildups, whenever firm leverage growth is above the country-industry median. Thus, this test compares the firms with their closely related peers (within the same NACE 4-digit industry in each country) based on the change in leverage. Panel B in Table 6 shows that the findings remain similar.

Finally, it can be sensible to compare each firm with itself. In particular, I examine whether firms experience different employment dynamics in the aftermath of large leverage buildups, when benchmarked against their own leverage path (by exploiting the within-firm variation in leverage growth over time). For this purpose, a dummy variable is assigned 1, whenever the change in leverage is above the firm median. Panel C in Table 6 depicts the results. They are in line with the previous findings, and suggest that employment growth increases in the shorter term, but decreases in the medium-term, following the periods in which firm increase their leverage more (relative to other periods).

[13] The coefficient estimates suggest that relatively high leverage buildups are associated with a 2.3 percentage points higher employment growth in the short-term (column 1), whereas firm employment growth experiences persistent declines in later periods (up to 1.8 percentage points as suggested by the result in column 4).

Table 6: Dummy variable approach

Panel A: Sample median						
Variable	$\Delta\log(Employment)_{j,t}$					
	$(t-3,t)$	$(t-2,t+1)$	$(t-1,t+2)$	$(t,t+3)$	$(t+1,t+4)$	$(t+2,t+5)$
$\Delta Leverage_{j,t}(t-3,t)$	2.316***	0.376***	-1.066***	-1.751***	-1.011***	-0.348***
	(0.037)	(0.039)	(0.036)	(0.034)	(0.036)	(0.040)
Firm F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Country-industry-year F.E.	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.359	0.383	0.389	0.386	0.404	0.419
Observations	15,716,519	11,232,556	9,345,424	8,346,025	6,407,734	5,142,150
Panel B: Country-industry median						
Variable	$\Delta\log(Employment)_{j,t}$					
	$(t-3,t)$	$(t-2,t+1)$	$(t-1,t+2)$	$(t,t+3)$	$(t+1,t+4)$	$(t+2,t+5)$
$\Delta Leverage_{j,t}(t-3,t)$	2.293***	0.336***	-1.106***	-1.792***	-1.026***	-0.355***
	(0.037)	(0.039)	(0.036)	(0.034)	(0.036)	(0.040)
Firm F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Country-industry-year F.E.	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.359	0.383	0.389	0.386	0.404	0.419
Observations	15,716,519	11,232,556	9,345,424	8,346,025	6,407,734	5,142,150
Panel C: Firm median						
Variable	$\Delta\log\,(Employment)_{j,t}$					
	$(t-3,t)$	$(t-2,t+1)$	$(t-1,t+2)$	$(t,t+3)$	$(t+1,t+4)$	$(t+2,t+5)$
$\Delta Leverage_{j,t}(t-3,t)$	1.571***	-0.024	-1.097***	-1.581***	-0.814***	-0.205***
	(0.031)	(0.034)	(0.031)	(0.030)	(0.033)	(0.037)
Firm F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Country-industry-year F.E.	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.359	0.383	0.389	0.386	0.404	0.419
Observations	15,716,519	11,232,556	9,345,424	8,346,025	6,407,734	5,142,150

Notes: Results are based on equation 2. In Panel A, the explanatory variable is a dummy variable which takes 1, whenever the change in firm leverage between t-3 and t is above the sample median. In Panel B, the explanatory variable is a dummy variable which takes 1, whenever the change in firm leverage between t-3 and t is above the country-industry median. In Panel C, the explanatory variable is a dummy variable which takes 1, whenever the change in firm leverage between t-3 and t is above the firm median. The dependent variable is the change in firm employment (in percent) during the periods as indicated in the columns. Industry stands for 4-digit NACE industries. Standard errors in parentheses are clustered at the country-industry-year level. *** p<0.01, ** p<0.05, * p<0.1.

4.4.2. An Alternative Measure of Leverage

Next, I adopt an alternative measure of leverage based on firm liabilities net of cash. The rationale behind this measure is as follows. A potential explanation for the previous findings is the financial drag that firms face following an increase in leverage. However, the degree of financial pressures can also depend on firms' ability to generate sufficiently high cash flows to repay debt and to undertake other operations. Moreover, firms may borrow to accumulate cash due to precautionary reasons (Alter and Elekdag 2020). Therefore, it is sensible to check whether the dynamic relationship

between leverage buildups and employment growth still holds once firm cash flows are accounted for. For this purpose, I employ the analysis by using an alternative measure of firm leverage which is based on net liabilities, i.e., total liabilities minus cash. Table 7 shows that the findings are robust to this netted measure of leverage.

Table 7: Leverage net of cash

Variable	$\Delta\log(Employment)_{j,t}$					
	$(t-3,t)$	$(t-2,t+1)$	$(t-1,t+2)$	$(t,t+3)$	$(t+1,t+4)$	$(t+2,t+5)$
$\Delta Leverage_{j,t}(t-3,t)$	0.033***	-0.014***	-0.038***	-0.042***	-0.020***	-0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Firm F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Country-industry-year F.E.	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.364	0.387	0.394	0.391	0.409	0.426
Observations	14,969,478	10,549,053	8,792,498	7,857,153	6,030,403	4,839,984

Notes: Results are based on equation 2. The explanatory variable is the change in firm leverage between t-3 and t (measured using net liabilities, i.e., total liabilities minus cash). The dependent variable is the change in firm employment (in percent) during the periods as indicated in the columns. Industry stands for 4-digit NACE industries. Standard errors in parentheses are clustered at the country-industry-year level. *** p<0.01, ** p<0.05, * p<0.1.

4.4.3. Alternative Explanations

The goal of this set of tests is to alleviate possible concerns about three alternative explanations, namely firm employment convergence, firm expansion and mean reversion channels. First, firms that have a higher (lower) level of employment to start with may have lower (higher) employment growth over time, if employment exhibits convergence across firms (i.e., if smaller firms tend to catch up with larger firms over time). If an increase in firm leverage is associated with a higher level of employment in the first place, the result that leverage buildups predict a decline in employment growth in the medium-term can be explained by this convergence. To test whether this drives the previous findings, I control for the initial level of employment in the specification in equation 2. Table 8 illustrates the findings. Although convergence seems to be important for future employment changes,[14] the previous relationship between firm leverage buildups and employment growth remains unchanged.

Next, firms can rely on debt to fund their expansions. If that is the case, firm expansions, or over-expansions, can play a role in the previous findings. To examine whether this is the case, I control for a measure of firm expansion, namely sales growth (as with Giroud and Mueller 2021). Table 9 shows the results. The previous relationship between firm leverage buildups and employment growth over time stays similar. It is also worth noting that firms with initially larger sales growth experience a decline in employment growth in later periods.

[14] The negative coefficient estimates of the control variable suggest that firms with initially higher level of employment tend to have lower employment growth subsequently.

Finally, I examine whether the medium-term association between firm leverage buildups and employment growth is indeed driven by an underlying mean reversion process in employment growth. In particular, if firm employment growth exhibits mean reversion, to the extent that leverage buildups are associated with an increase employment growth in the short-term, the negative relationship between leverage buildups and employment growth in the medium-term may be driven by this mean reversion process. To test this, I control for employment growth in the first period and run the regressions for the rest of the periods (i.e., $p = 1, \dots, 5$). Table 10 shows the findings. Although firm employment growth tends to exhibit mean reversion in later periods, the predictive power of leverage buildups in the medium-term employment growth remains similar.

In sum, employment convergence, firm expansion and mean reversion in employment growth do not alter the nature of the relationship between firm leverage buildups and employment growth. However, those channels appear to be important for employment dynamics.

Table 8: Catch up effect

Variable	$\Delta\log(Employment)_{j,t}$					
	$(t-3,t)$	$(t-2,t+1)$	$(t-1,t+2)$	$(t,t+3)$	$(t+1,t+4)$	$(t+2,t+5)$
$\Delta Leverage_{j,t}(t-3,t)$	0.016***	-0.036***	-0.061***	-0.063***	-0.028***	-0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$\log(Employment)_{j,t}\,(t-3)$	-0.629***	-0.349***	-0.202***	-0.123***	-0.065***	-0.028***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Firm F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Country-industry-year F.E.	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.603	0.454	0.413	0.395	0.406	0.420
Observations	15,716,519	11,232,556	9,345,424	8,346,025	6,407,734	5,142,150

Notes: Results are based on equation 2. The explanatory variable is the change in firm leverage between t-3 and t. The dependent variable is the change in firm employment (in percent) during the periods as indicated in the columns. Firm employment level at t-3 is included. Industry stands for 4-digit NACE industries. Standard errors in parentheses are clustered at the country-industry-year level. *** p<0.01, ** p<0.05, * p<0.1.

Table 9: Firm expansion

Variable	$\Delta\log(Employment)_{j,t}$					
	$(t-3,t)$	$(t-2,t+1)$	$(t-1,t+2)$	$(t,t+3)$	$(t+1,t+4)$	$(t+2,t+5)$
$\Delta Leverage_{j,t}(t-3,t)$	0.050***	-0.018***	-0.054***	-0.060***	-0.026***	-0.003**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$\Delta log(Sales)_{j,t}(t-3,t)$	0.295***	0.203***	0.082***	-0.030***	-0.056***	-0.050***
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)
Firm F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Country-industry-year F.E.	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.426	0.415	0.395	0.387	0.406	0.422
Observations	14,891,787	10,702,235	8,911,219	7,965,282	6,113,634	4,908,464

Notes: Results are based on equation 2. The explanatory variable is the change in firm leverage between t-3 and t. The dependent variable is the change in firm employment (in percent) during the periods as indicated in the columns. Firm sales growth between t-3 and t is included (in percent). Industry stands for 4-digit NACE industries. Standard errors in parentheses are clustered at the country-industry-year level. *** p<0.01, ** p<0.05, * p<0.1.

Table 10: Mean reversion

Variable	$\Delta\log(Employment)_{j,t}$				
	$(t-2,t+1)$	$(t-1,t+2)$	$(t,t+3)$	$(t+1,t+4)$	$(t+2,t+5)$
$\Delta Leverage_{j,t}(t-3,t)$	-0.046***	-0.056***	-0.037***	-0.013***	-0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$\Delta log(Employment)_{j,t}(t-3,t)$	0.401***	0.024***	-0.353***	-0.195***	-0.115***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)
Firm F.E.	Yes	Yes	Yes	Yes	Yes
Country-industry-year F.E.	Yes	Yes	Yes	Yes	Yes
R-squared	0.485	0.389	0.469	0.429	0.428
Observations	11,232,556	9,345,424	8,346,025	6,407,734	5,142,150

Notes: Results are based on equation 2. The explanatory variable is the change in firm leverage between t-3 and t. The dependent variable is the change in firm employment (in percent) during the periods as indicated in the columns. Firm employment growth between t-3 and t is included. Industry stands for 4-digit NACE industries. Standard errors in parentheses are clustered at the country-industry-year level. *** p<0.01, ** p<0.05, * p<0.1.

4.4.4. Sample

In this section, I test whether the results stay similar in various subsamples. I start by focusing on service industries, since they have become increasingly important for Europe. The results in Table 11 (Panel A) show that the previous findings remain similar when tested for service industries. Panel B runs the tests with the rest of the industries, and shows that the results still hold for non-service industries.

Table 11: Service and non-service industries

Panel A: Service industries						
Variable	$\Delta\log(Employment)_{j,t}$					
	$(t-3,t)$	$(t-2,t+1)$	$(t-1,t+2)$	$(t,t+3)$	$(t+1,t+4)$	$(t+2,t+5)$
$\Delta Leverage_{j,t}(t-3,t)$	0.030***	-0.029***	-0.057***	-0.059***	-0.026***	-0.003**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Firm F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Country-industry-year F.E.	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.352	0.374	0.380	0.377	0.394	0.408
Observations	10,211,903	7,255,231	5,976,859	5,324,134	4,060,875	3,235,367
Panel B: Non-service industries						
Variable	$\Delta\log(Employment)_{j,t}$					
	$(t-3,t)$	$(t-2,t+1)$	$(t-1,t+2)$	$(t,t+3)$	$(t+1,t+4)$	$(t+2,t+5)$
$\Delta Leverage_{j,t}(t-3,t)$	0.012***	-0.030***	-0.051***	-0.056***	-0.025***	-0.005**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Firm F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Country-industry-year F.E.	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.372	0.397	0.404	0.402	0.420	0.437
Observations	5,504,616	4,007,325	3,368,505	3,021,891	2,346,859	1,906,783

Notes: Results are based on equation 2. The explanatory variable is the change in firm leverage between t-3 and t. The dependent variable is the change in firm employment (in percent) during the periods as indicated in the columns. Panel A and Panel B run the tests using data from services (with 1-digit NACE codes of G, H, I, J, L, M and N) and non-services, respectively. Industry stands for 4-digit NACE industries. Standard errors in parentheses are clustered at the country-industry-year level. *** p<0.01, ** p<0.05, * p<0.1.

Next, I aim to make sure that large employment fluctuations in the firms with relatively small number of employees do not drive the results. These tests also address possible concerns about the reliability of data regarding smaller firms. For these purposes, I use data only from the firms that consistently report 5 or more employees. Table 12 shows that the results are similar.[15]

Finally, I restrict the analysis to the subsample of firms which have at least 10 years of data over the sample period. This subsample, therefore, consists of the firms that appear across all six regressions, since the last test (with $p = 5$) requires at least 10 years of data for a firm to be included in that regression. Table 13 shows that the results stay similar in this subsample as well.[16]

[15] The results also remain similar when weighted regressions are employed in the full sample, with the weights being the number of employees for each firm (averaged over the period of the analysis), in order to decrease the influence of firms with lower employment.

[16] These findings also stay similar when this relationship is tested with (i) the continuing sample of the firms (i.e., by using data only from the firms that report all the years throughout the sample period), (ii) the half of the countries or industries with the largest number of observations.

Table 12: Firms with larger number of employees

Variable	$\Delta\log(Employment)_{j,t}$					
	$(t-3,t)$	$(t-2,t+1)$	$(t-1,t+2)$	$(t,t+3)$	$(t+1,t+4)$	$(t+2,t+5)$
$\Delta Leverage_{j,t}(t-3,t)$	0.018***	-0.004***	-0.029***	-0.044***	-0.030***	-0.015***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Firm F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Country-industry-year F.E.	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.381	0.394	0.400	0.399	0.415	0.432
Observations	5,506,573	4,116,358	3,525,000	3,197,266	2,551,826	2,123,342

Notes: Results are based on equation 2. The explanatory variable is the change in firm leverage between t-3 and t. The dependent variable is the change in firm employment (in percent) during the periods as indicated in the columns. The tests are run using data only from the firms which consistently report five or more employees over the sample period. Industry stands for 4-digit NACE industries. Standard errors in parentheses are clustered at the country-industry-year level. *** p<0.01, ** p<0.05, * p<0.1.

Table 13: Firms with at least 10 years of data

Variable	$\Delta\log(Employment)_{j,t}$					
	$(t-3,t)$	$(t-2,t+1)$	$(t-1,t+2)$	$(t,t+3)$	$(t+1,t+4)$	$(t+2,t+5)$
$\Delta Leverage_{j,t}(t-3,t)$	0.035***	-0.021***	-0.054***	-0.060***	-0.026***	-0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Firm F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Country-industry-year F.E.	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.262	0.305	0.326	0.328	0.378	0.417
Observations	10,871,059	8,818,541	7,861,478	7,360,374	6,065,123	5,114,534

Notes: Results are based on equation 2. The explanatory variable is the change in firm leverage between t-3 and t. The dependent variable is the change in firm employment (in percent) during the periods as indicated in the columns. The tests are run using data only from the firms with data available for at least 10 years. Industry stands for 4-digit NACE industries. Standard errors in parentheses are clustered at the country-industry-year level. *** p<0.01, ** p<0.05, * p<0.1.

4.5. Firm Leverage Buildups and the Volatility of Employment Growth

In this section, I examine whether the initial boost and the subsequent decline in firm employment growth as predicted by leverage buildups have implications for the volatility of employment growth. To test this phenomenon empirically, I construct a time variant measure of volatility by adopting a methodology similar to Morgan et al. (2004). I first regress the 3-year firm employment growth on firm and country-industry-year fixed effects for each period (i.e., $p = 0, \dots, 5$). The residuals from those regressions reflect how much a firm's employment growth differs from (i) the average employment growth of this firm over the sample period, and also from (ii) the mean employment growth across all firms within each country-industry-year cell. The absolute value of the residuals represents the extent of fluctuations with respect to (i.e., absolute deviations from) (i) the firm's own mean employment growth, and (ii) the average employment growth of other firms within each country-industry-year. This provides a year-by-year volatility measure of employment growth, which can be used in panel regressions with annual data and

viewed as annual equivalent of the standard deviation measure (Kalemli-Ozcan et al. 2014). I adopt this measure as the dependent variable.

Table 14 represents the results. The coefficient estimates of the change in leverage are positive and statistically significant at the 1 percent level across all periods. This suggests that leverage buildups predict an increased volatility of firm employment growth both in the short- and medium-term. This result can be considered as consistent with the previous findings on boom-bust growth cycles associated with rising firm leverage.

Table 14: Firm leverage buildups and the volatility of employment growth

Variable	$Volatility(\Delta\log(Employment)_{j,t})$					
	$(t-3,t)$	$(t-2,t+1)$	$(t-1,t+2)$	$(t,t+3)$	$(t+1,t+4)$	$(t+2,t+5)$
$\Delta Leverage_{j,t}(t-3,t)$	0.008***	0.013***	0.012***	0.009***	0.006***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Firm F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Country-industry-year F.E.	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.473	0.492	0.504	0.517	0.537	0.549
Observations	15,716,519	11,232,556	9,345,424	8,346,025	6,407,734	5,142,150

Notes: Results are based on equation 2. The explanatory variable is the change in firm leverage between t-3 and t. The dependent variable is the annual volatility of firm employment growth during the periods as indicated in the columns. Industry stands for 4-digit NACE industries. Standard errors in parentheses are clustered at the country-industry-year level. *** p<0.01, ** p<0.05, * p<0.1.

4.6. Firm Leverage Buildups and Financial Distress

In this section, I switch to the role of tightening firm-level financial constraints in the previous findings. In this regard, an intuitive balance sheet metric to look at is firm debt service ratio, which captures the drag on firm balance sheet arising from debt payments, and serves a proxy for financial distress encompassing both solvency and liquidity dimensions (Diez et al. 2021b, Kalemli-Ozcan et al. 2022). An increase in firm leverage can elevate balance sheet pressures in the form of higher interest payments over time, possibly crowding out resources which can otherwise be used for production purposes. This can in turn hinder employment growth. To examine whether this is the case, I estimate the specification in equation 2 by replacing the dependent variable with debt service ratio. Table 15 presents the findings.

The results show that firm balance sheets seem to benefit from leverage buildups in the first period, whereas financial pressures arise in the medium-term. The positive coefficient estimate in the first column shows that firms face lower interest payments relative to earnings in the short-term (possibly driven by firm expansions funded by borrowing). However, this relationship is reversed quickly. For the rest of the periods, firms with higher leverage buildups persistently spend a higher fraction of their earnings to meet interest payments. This dynamic relationship between firm leverage buildups and debt service ratio is in line with the previous findings, pointing to the drag on finances in the previous patterns.

Table 15: Firm leverage buildups and debt service ratio

Variable	$DSR_{j,t+p}$					
	$p=0$	$p=1$	$p=2$	$p=3$	$p=4$	$p=5$
$\Delta Leverage_{j,t}(t-3,t)$	-0.054***	0.039***	0.042***	0.035***	0.032***	0.029***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Firm F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Country-industry-year F.E.	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.341	0.350	0.357	0.366	0.373	0.384
Observations	11,315,551	8,942,349	7,439,965	6,209,817	5,086,982	4,179,399

Notes: Results are based on equation 2. The explanatory variable is the change in firm leverage between t-3 and t. The dependent variable is firm DSR (defined as interest paid as percentage of EBITDA) in the years as indicated in the columns. Industry stands for 4-digit NACE industries. Standard errors in parentheses are clustered at the country-industry-year level. *** p<0.01, ** p<0.05, * p<0.1.

4.7. Firm Leverage Buildups and Investment

If financial constraints stemming from rising leverage indeed play a role in the previous findings, it can be expected that similar boom-bust cycles after leverage buildups should also be pronounced for investment. The results in Table 16 show that this is indeed the case: Leverage expansions predict a boost in investment in the short-term, whereas investment declines in the medium-term.

The magnitude of the coefficient estimate in column 1 suggests that an increase in leverage in the amount of one standard deviation of the change predicts a 4.8 percentage points higher investment rate during the same period. This is large given that the mean value of the 3-year investment in the sample is 7.2 percent. The positive coefficient estimate in the second column suggests that this association remains positive during the next 3-year window, albeit becoming lower.

The sign of the coefficient estimates switches for the rest of the columns, meaning a negative relationship between leverage buildups and investment in the medium-term. For instance, the result in the fourth column, where the magnitude of the coefficient estimate is the largest, suggests that a one standard deviation leverage buildup (between $t-3$ and t) is related to a 3.7 percentage points lower investment rate between t and $t+3$. I conclude that boom-bust cycles as predicted by firm leverage buildups are not limited to employment growth, but are also pronounced in the case of investment.

Table 16: Firm leverage buildups and investment

Variable	$\Delta\log(Fixed\ assets)_{j,t}$					
	$(t-3,t)$	$(t-2,t+1)$	$(t-1,t+2)$	$(t,t+3)$	$(t+1,t+4)$	$(t+2,t+5)$
$\Delta Leverage_{j,t}(t-3,t)$	0.227***	0.042***	-0.077***	-0.173***	-0.081***	-0.029***
	(0.004)	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)
Firm F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Country-industry-year F.E.	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.385	0.399	0.395	0.390	0.406	0.417
Observations	14,221,120	10,297,566	8,583,413	7,644,734	5,874,540	4,706,550

Notes: Results are based on equation 2. The explanatory variable is the change in firm leverage between t-3 and t. The dependent variable is firm investment (the change in fixed assets, in percent) during the periods as indicated in the columns. Industry stands for 4-digit NACE industries. Standard errors in parentheses are clustered at the country-industry-year level. *** p<0.01, ** p<0.05, * p<0.1.

4.8. The Role of Aggregate Financial Conditions

Finally, I investigate the role of aggregate financial conditions in the medium-term relationship between firm leverage buildups and employment growth. To the extent that the negative role of leverage buildups in firm employment growth over the medium-term (as found previously) is driven by a financial channel, tightening financial conditions in a country can affect this relationship. That is, leverage buildups weaken firm balance sheet and increase financial fragility, making firms more prone to financial conditions. As a result, the medium-term decline in firm employment growth as predicted by leverage buildups can become even larger, if financial conditions turn out to be tighter. To test this phenomenon empirically, I include the interaction between the change in firm leverage and a proxy for a larger-than-expected tightening in financial conditions (i.e., average forecast errors of long-term rates during each period) based on the specification in equation 3. Table 17 illustrates the results.

The coefficient estimates for the change in leverage is negative in all periods for $p = 1, \dots, 5$, consistent with the findings above. Moreover, the coefficient estimates for the interaction term are negative and statistically significant for all periods (at least at the 10 percent level). This means that as financial conditions become tighter, firms with initially larger leverage expansions experience disproportionately higher losses in employment growth. This points to the role of a financial channel in the previously shown medium-term association between firm leverage buildups and employment growth.

Table 17: The role of aggregate financial conditions

Variable	$\Delta\log(Employment)_{j,t}$				
	$(t-2,t+1)$	$(t-1,t+2)$	$(t,t+3)$	$(t+1,t+4)$	$(t+2,t+5)$
$\Delta Leverage_{j,t}(t-3,t)$	-0.058***	-0.070***	-0.069***	-0.022***	-0.013***
	(0.004)	(0.003)	(0.003)	(0.004)	(0.004)
$\Delta Leverage_{j,t}(t-3,t) \times X^{p}_{c,t}$	-0.007***	-0.004***	-0.003***	-0.001**	-0.001*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Firm F.E.	Yes	Yes	Yes	Yes	Yes
Country-industry-year F.E.	Yes	Yes	Yes	Yes	Yes
R-squared	0.401	0.402	0.409	0.422	0.435
Observations	10,300,308	8,577,800	7,237,410	5,645,906	4,498,481

Notes: Results are based on equation 3. The explanatory variable is the change in firm leverage between t-3 and t. The dependent variable is the change in firm employment (in percent) during the periods as indicated in the columns. The interaction between the change in firm employment (between t-3 and t) and the average long-term interest rates (forecast errors during the corresponding periods) is included. Industry stands for 4-digit NACE industries. Standard errors in parentheses are clustered at the country-industry-year level. *** p<0.01, ** p<0.05, * p<0.1.

5. Conclusions and Implications

This paper explores the dynamic relationship between firm debt and real outcomes based on data from 24 advanced European economies over the period of 2000-2018. It starts by showing that expansions in credit to firms predict a boost in aggregate employment growth initially, but employment growth declines in the medium-term. This result still holds, even when household debt dynamics are accounted for. The results also show that an accumulation of household debt is not much associated with an initial boost in employment growth; but similar to a rise in firm debt, it predicts a decline in employment growth in the medium-term.

Next, using data from a large sample of firms, this study finds a similar pattern at the firm-level as well: Firm leverage expansions predict a boost in firm employment growth in the short-term, whereas employment growth decreases in the medium-term. It is hard to make a causal claim, but the firm-level empirical specifications absorb the effects of other factors on employment growth at a very granular level, and robustness tests rule out various alternative explanations for this dynamic relationship. The results also show that boom-bust growth cycles in firm employment as predicted by leverage buildups have implications for the volatility of employment growth: In the aftermath of a rise in firm leverage, the volatility of employment growth increases both in the short- and medium-term.

Finally, this paper provides suggestive evidence on the role of a financial channel in the medium-term relationship between firm leverage buildups and employment growth by focusing on firm balance sheet and investment, as well as by exploiting the cross-country heterogeneity in financial conditions. The results show that firms with a larger increase in leverage persistently use a larger fraction their earnings for interest payments, which leave less resources for production activities, thereby potentially hindering employment growth in the medium-term. Consistently, boom-bust cycles as predicted by firm leverage

buildups are not restricted to employment growth, but are also pronounced for investment: Firm leverage buildups promote investment in the short-term, while holding investment back in the medium-term. Finally, this paper examines this phenomenon by focusing on the role of aggregate financial conditions in the medium-term relationship between firm leverage buildups and employment growth. It shows that firms with an initially larger expansion in leverage face even larger declines in employment growth in the medium-term if financial conditions tighten, further pointing to a financial channel.

The findings on the predictive power of firm leverage buildups on boom-bust growth cycles in economic outcomes, and on the role of a financial channel in this relationship, have important policy implications. Policies that incentivize/allow firms to increase their borrowing, such as loose macroprudential policies or low interest rates, should be mindful of possible medium-term effects of leverage buildups in the real sector. The findings suggest that such policies which could be growth-enhancing in the short-term can yield undesirable outcomes in the medium-term. This is in favor of more proactive policy measures to “lean against the wind of incipient credit booms” (Greenwood et al. 2022): When an economy is experiencing large leverage buildups in the real sector, various well-designed and targeted macroprudential tools to strengthen firm balance sheets could be considered to balance potential short-term benefits and medium-term costs of rising leverage levels. Under some conditions, another policy option to lean against the wind could be a tightening in monetary policy, but that option should be treated with caution, since it is a less targeted approach relative to macroprudential tools, and thus related economic costs can outweigh benefits (e.g., Brandao-Marques et al. 2020, Biljanovska et al. 2023).

The implications of the findings are even more crucial in the post-Covid-19 world. Nonfinancial sector leverage has been increasing running up to the pandemic, reaching to historical highs, due to a loosening in financial conditions since the Global Financial Crisis in 2008. In addition, as a response to the Covid-19 shock, policymakers stepped in with the view of supporting the flow of credit, which has contributed to a further increase in nonfinancial sector leverage (IMF 2021). In this context, the findings in this study point to a policy trade-off between supporting growth in the short-term through an easing of financial conditions while containing downside macro-financial stability risks going forward.

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Appendix

Table A.1: Summary statistics

Panel A. Firm-level variables				
	25th ptile	Median	Mean	75th ptile
Leverage, 3-year growth (pp)	-10.998	-1.571	-1.150	6.415
Net leverage, 3-year growth (pp)	-14.988	-1.598	-1.485	10.306
Debt service ratio (%)	0.448	6.100	13.048	22.292
Number of employees (#)	2	5	16.873	14
Employment, 3-year growth (%)	-14.310	0	1.318	18.232
Investment, 3-year (%)	-10.721	-1.640	7.209	38.870
Sales, 3-year growth (%)	-25.640	1.242	4.328	32.249
Panel B. Country-level variables				
	25th ptile	Median	Mean	75th ptile
Firm credit, 3-year growth (pp)	-4.042	0.342	0.192	4.150
Household credit, 3-year growth (pp)	-2.400	3.370	2.378	7.780
Employment, 3-year growth (%)	0.045	2.627	2.181	4.575
GDP, 3-year growth (%)	1.694	5.332	5.442	8.977

Table A.2: Industries

NACE code	NACE 2-digit range	Industry
B	5-9	Mining and quarrying
C	10-33	Manufacturing
D	35	Electricity, gas, steam and air conditioning supply
E	36-39	Water supply; sewerage; waste management and remediation activities
F	41-43	Construction
G	45-47	Wholesale and retail trade; repair of motor vehicles and motorcycles
H	49-53	Transporting and storage
I	55-56	Accommodation and food service activities
J	58-63	Information and communication
L	68	Real estate activities
M	69-75	Professional, scientific and technical activities
N	77-82	Administrative and support service activities

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